

# **CHARGED-PARTICLE-BEAM MICROLITHOGRAPHY METHODS AND APPARATUS PROVIDING REDUCED RETICLE HEATING**

5

## **Abstract of the Disclosure**

Charged-particle-beam (CPB) microlithography methods and apparatus are disclosed that suppress increases in reticle temperature caused by CPB irradiation during exposure. The methods and apparatus employ a reticle segmented into subfields or analogous exposure units arranged into minor stripes and at least one major stripe. At least some of the minor stripes comprise a region in which the constituent minor stripes are illuminated multiple times to achieve transfer of the respective pattern portions to a corresponding region on the substrate. Each time a constituent minor stripe is illuminated, the beam energy is reduced, thereby reducing reticle heating. After a subfield in the region has been transferred multiple times to a corresponding transfer subfield on the substrate, the net exposure energy received by the transfer subfield is the same as if the transfer subfield had been exposed only once at a correspondingly higher dose.